



Regulatory Use of Human Activity Pattern Data in Pesticide Exposure Assessments



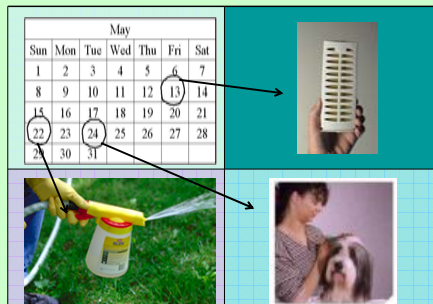
The Need for Time and Activity Data

- With the passage of FQPA, the US EPA must consider the potential for aggregate & cumulative exposure to pesticides when assessing risks to human health.
- The availability of high quality time and activity data and well designed probabilistic risk assessment models enhances the Agency's ability to accomplish this mandate.
- Time and activity data provides information how and when exposures occur. This type of information is essential in estimating residential exposure with the aggregate models.

How Time and Activity Data are Used

Tiering Process for Probabilistic Risk Assessment

- Tier 1 Assumption:
 - Use Distributions of Time Spent (By Age Group) from US EPA Exposure Factors Handbook
- Tier 2 Refinement:
 - Comprehensive Time Spent and Activities to Calculate Total Indoor Inhalation using the CHAD data and MET Generator



Example: Organophosphorus Pesticides Cumulative Exposure Assessment

How Time Use Data is Used in Tier 1 Assessment:

The probabilistic model used in the OP CRA (Calendex) calculates an individuals' total inhalation by independently drawing a random value for each exposure factor (time, breathing rate) from their respective distributions. The model can use the individuals' Basal Metabolic Rate to calculate resting breathing rates.

Limitations of Tier 1:

That approach does not account for any correlations between exposure duration (time spent) and activities (play, rest), etc. – People that spent 24 hours indoors may have lower average breathing rates (e.g., stayed at home sick)

Tier 2 Refinement:

The CHAD MET Generator enables exposure modelers to comprehensively use both the time spent and activities engaged in to calculate distributions of total indoor breathing rates for each CHAD diary.

$$IE = C_{air} \times BMR \times H \times VQ \times MET_TIME$$

Where IE=Inhalation Exposure (mg ai/kg bwt/day), and BMR=Basal Metabolic Rate (MJ/hr), $H=0.05$ m³/MJ, a constant representing the volume of oxygen consumed in the production of 1 MJ of expended energy, $VQ=27$, a conversion factor reflecting the ratio between the amount of air breathed to the amount of oxygen obtained, and MET_TIME (hr) is the product of an activity-specific metabolic factor (MET) and the time spent in that activity (hr) – summed over all exposure events in the diary (day). See US EPA Exposure Factors Handbook for further discussion of this model.

- Using the CHAD MET Generator, the Agency modeled total daily inhalation exposure from registered (specific locations) use of pest strips based on the time use diaries.

Next Steps

- Empirical Use of CHAD Time Use Diaries to Model Individuals' Activities
 - SHEDS
 - Lifeline-NHAPS
 - CARES (HESI)
 - Calendex
- CHAD Data QC
 - Specific Location (e.g., Fraction of Time Spent Outdoors playing on deck or lawn)
 - Specific Activities (e.g., child repairing automobile)
- ORD Longitudinal Studies
- National Children's Study

The **Consolidated Human Activity Database (CHAD)**, developed by the US EPA ORD-NERL, was created to support exposure, intake dose, and risk assessments. This meta data base contains 22,968 person-day diaries assembled from 10 different time use surveys. For further information, see <http://www.epa.gov/chadnet1/>.

EPA\OPP Modeling Team

Alan Dixon
David Hrdy
Steve Nako
Dana Vogel

Jeff Evans
David Miller
Sheila Piper
Philip Villanueva

Special Thanks to Tom McCurdy, ORD.